

A COLLECTION OF NORWEGIAN FLEAS (SIPHONAPTERA) NORTH OF THE ARCTIC CIRCLE

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Abstract.—Fleas (444 specimens) were collected from 8 species of small mammals north of the Arctic Circle in the northern Norwegian counties of Finnmark, Troms, and Nordland. These fleas represented 14 species belonging to 5 families. The most common flea, *Palaeopsylla soricis soricis* (Dale, 1878) found almost exclusively on *Sorex araneus* Linnaeus, 1758 comprised 31.7% of the total number. *Ischnopsyllus hexactenus* (Kolenati, 1856) is reported for the first time in Norway, and *Megabothris walkeri* (Rothschild, 1902) and *Peromyscopsylla bidentata bidentata* (Kolenati, 1863) are reported north of the Arctic Circle for the first time. The zone of intergradation of the subspecies *Amalaraeus penicilliger pedias* (Rothschild, 1911) and *Amalaraeus p. mustelae* (Dale, 1878) in Norway is defined at ~67°N latitude. *Sorex araneus* and *Clethrionomys rutilus* (Pallas, 1779) were each host to 9 species of fleas.

Key Words: fleas, Siphonaptera, Norway

The Scandinavian Peninsula (Norway and Sweden) shares faunal affinities with Denmark, Finland, and in part with north central Europe and northwestern Asia. Smit (1969) provided a catalogue of fleas of Finland and reported their distribution to include some that extend into Norway, at the northern confluence of the 2 countries. Brink-Lindroth (1972, 1974) illustrated the subspecific differences and distribution of 2 common species in Finland and Scandinavia (*Palaeopsylla soricis* ssp. and *Amalaraeus penicilliger* ssp.) and in western and central Europe (*Amalaraeus penicilliger* ssp.), respectively. Brink-Lindroth (1980) also compared the flea fauna of the mountains of Scandinavia to those of the Pyrenees of Spain. Other miscellaneous records and reports of Norway fleas include those

of Cotton (1963), Dunnet (1962), Jellison (1962), Jordan (1932a, b), Marriott (1968), Mehl (1967a, b, c), Rothschild (1911), and Sinclair & Ewning (1963).

This paper treats a collection of fleas primarily from common cricetid rodents and soricid shrews distributed throughout the three northern Norwegian counties north of the Arctic Circle (66°33'N). One species of bat flea is reported north of the Arctic Circle for the first time, the distribution of several species is expanded, and host-parasite relationships are discussed.

MATERIALS AND METHODS

Most of the small mammals were trapped in Ugglan Special® live traps, using dog chow and commercial rodent feed (various seeds) as bait. Traps were placed on line at

10 m intervals. The purposes of this study were to examine the distribution of small mammals in forested areas of northern Norway and to study morphological adaptations and population cycles in *Sorex araneus* Linnaeus, 1758. A few mammals were also trapped by Statskog-Fjelltjenesten using snap traps as part of their annual trapping scheme at fixed localities, and a collection of water voles, *Arvicola terrestris* Linnaeus, 1758, was given to the Tromsø Museum by Nils-P. Thommesen. Trapping periods were completed during the summer and autumn months from July to November 1998–2001. To facilitate clarity and associate each flea species with UTM coordinates (ED50 system), general habitat types, and elevations (meters), the following data are presented by counties. Numbered collection localities are illustrated in Fig. 1 and appear in parentheses adjacent to the locality descriptions below.

FINNMARK COUNTY

Vestre Jakobselv (15)(35W 5885 77821)—
Birch forest and meadow, 50–80 m

NORDLAND COUNTY

Balvatnet (3) (33W 5412 74302)—Subalpine birch forest to low alpine, 600–680 m.

Bliksvær (4) (33W 456 7462)—Meadow, 10–20 m.

Råndalen (6) (33W 5844 75746)—Birch forest, willow, rowan, etc., 20–60 m.

Saltdal (2) (33W 516 7311)—Pine forest, 120 m.

Skjomdalen (7) (33W 6068 75628)—Deciduous (birch, alder, etc.), and pine forest, 100 m; (33W 6105 75633)—Birch forest to low alpine, 400–480 m.

Sørelva (1) (33W 518 7396)—Birch forest to low alpine, 610–680 m.

Straumvatnet (5) (33W 528 74688)—Birch forest mixed with aspen, willows, etc., 10–50 m.

TROMS COUNTY

Budalen (8) (34W 3858 7619)—Birch forest, 200–240 m.

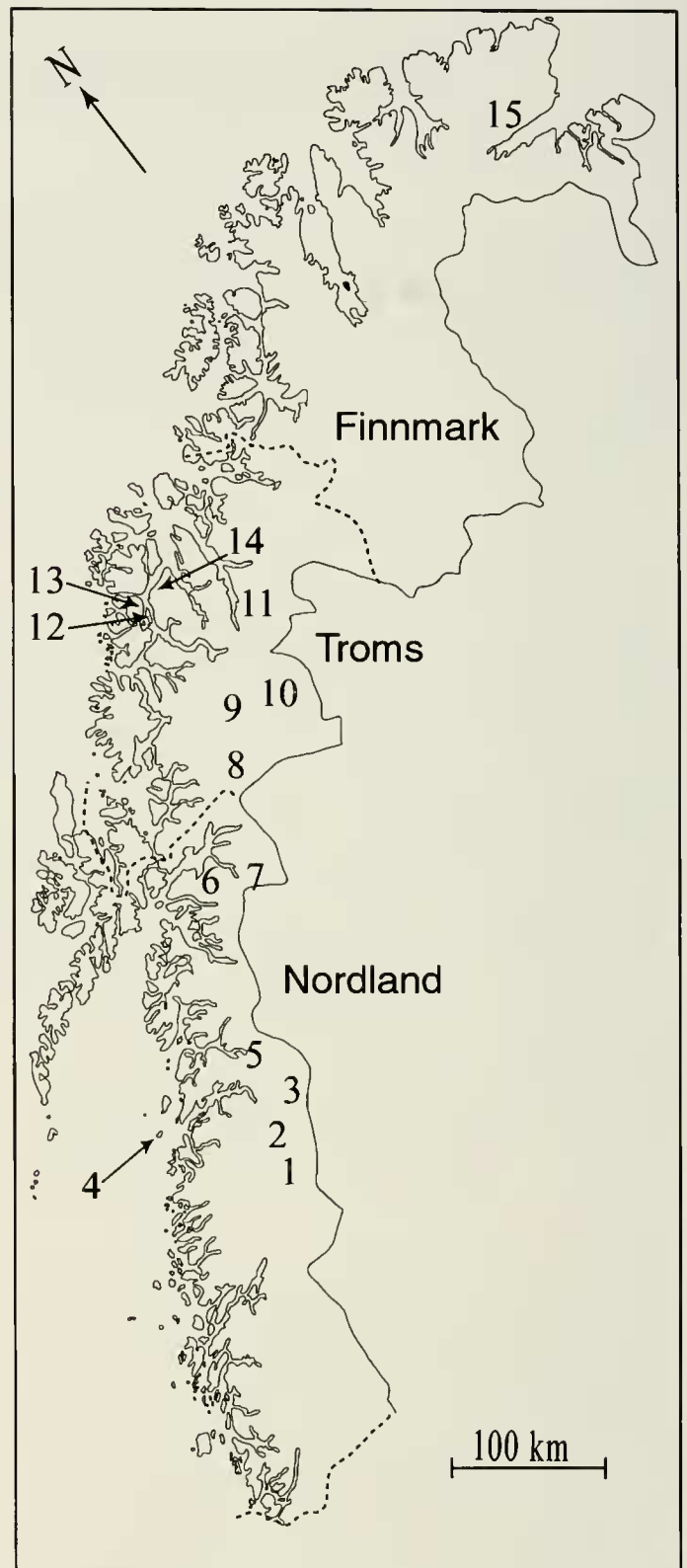


Fig. 1. Map of Norway illustrating mammal collection sites (see Materials and Methods for details).

Dividalen (10) (34W 436 7657)—Spruce forest, 90 m.

Kirkesdalen (9) (34W 416 7654–7)—Deciduous forest (birch, alder, etc.), 40–60 m.

Kvaløya (13) (34W 4213 77373)—Pasture in birch forest, 40 m.

Skibotndalen (11) (34W 4728 76926)—Moist birch forest with some pine, 30 m;

(34W 4775 76875)—Birch and pine forest, each with dry and moist areas, 100 m;

(34W 4878 76781)—Willow thicket with birch, 330 m; and

(34W 4905 76723)—Deciduous forest (birch, willow), 500 m.

Tønsvikdalen (14) (34W 4295 77380)—Birch forest, 30 m.

Tromsø (12) (Museum)(34W 4189 77265)—Within museum, 30 m.

Table 1 provides the number of males/females of each flea species collected from each locality. Host/parasite records are listed in Table 2. A small disparity between the number of specimens in the 2 tables is attributed to some specimens for which the certainty of the host was unknown. In such cases, a count of those fleas was not included in Table 2.

CERATOPHYLLIDAE

Amalaraeus penicilliger pedias (Rothschild, 1911)

Populations of the 2 subspecies *A. p. pedias* and *A. p. mustelae* (Dale 1878) meet just north of the Arctic Circle, the former representing the northern population. Brink-Lindroth (1972) stated, “*A. p. pedias* and *A. p. mustelae* are indistinguishable in the male as regards the basimeres and telomeres and the location of the spiniforms on the posterior margin of the telomeres” but indicated the hamuli (= crochets) are diagnostic. Morphometric studies by Brink-Lindroth (1974) confirmed these observations. All males from Straumvatnet north to Kvaløya/Tønsvikdalen are clearly *A. p. pedias* based on the hamuli. A deep sinus and extended dorsal lobe of st. VII is indicative of associated females also. A single female approximately 50 km south of Straumvatnet is either an intergrade of the 2 forms or *A. p. mustelae*. The dorsal lobe of the st. VII was very short and truncate with only a shallow subtending sinus. It appears from these data in conjunction with reports by Smit (1969) and Brink-Lindroth (1972) that

the southern limit of *A. p. pedias* in Norway occurs north of 67°N latitude. Species associated with specific localities are listed in Table 1.

Most specimens were recovered from *Clethrionomys rutilus* (Pallas, 1779) with stragglers from *C. rufocanus* (Sundevall, 1846), *Sorex araneus* Linnaeus, 1758, and *Microtus agrestis* (Linnaeus, 1761). Smit (1969) and Brink-Lindroth (1972) suggested that the preferred host in Finland and Sweden, respectively, was *Clethrionomys glareolus* (Schreber, 1780). In our study area, *C. glareolus* and *C. rutilus* do not co-exist except in the region of Skjomdalen. Populations of the former occur to the south of Skjomdalen and the latter to the north. Sixty-five *C. glareolus* specimens were examined without recovery of a single specimen of *A. p. pedias*, while 134 *C. rutilus* harbored 43 of the 65 specimens collected (66.1%) (Table 2). These data would suggest that *A. p. pedias* prefers *C. rutilus* (or their biohabitats) over that of *C. glareolus* in northern Norway and is displaced by *A. p. mustelae* on *C. glareolus*, particularly to the south of the Arctic Circle.

CTENOPHTHALMIDAE

Corrodopsylla birulai (Ioff, 1928)

This flea is confined to the northern Palaearctic Region from the Scandinavian Laplands, through northern Asia to Hokkaido, Japan. We found this flea distributed widely in low numbers from ~68°30'N to 70°N latitude on *S. araneus*. The zoogeography of this genus is of particular interest. *Corrodopsylla birulai* is Palaearctic, occurring only in northeastern Europe and Asia, while the other three species in the genus are restricted to the Nearctic Region. The southern limits of *C. birulai* appear to run from northern Norway to Sweden (66°N), Mongolia (47°48'N), Primorsky Krai (45°N) to Hokkaido, Japan (44°N). Ioff and Skalon (1954) report this species in the Arkhangelsk and Transbaikalia Regions as well.

Table 1. The number of males/females of each flea species listed by locality (county).

Locality	Flea Species				
	<i>Amalaraeus penicilliger pedias</i>	<i>Amphipsylla sibirica sibirica</i>	<i>Corrodopsylla birulai</i>	<i>Ctenophthalmus agyrtes agyrtes</i>	<i>Ctenophthalmus uncinatus uncinatus</i>
Finnmark County					
Vestre Jakobselv			2/0		
Nordland County					
Balvatnet	0/1				
Bilksvær				8/11	
Råndalen					
Saltdal					0/1
Skjomdalen	1/3	12/7			0/1
Sørelva	0/1				
Straumvatnet	1/0				0/2
Troms County					
Budalen			0/2		
Dividalen					
Kirkesdalen	2/2				
Kvaløya	22/18	10/6	1/0		
Skibotndalen	8/16	3/10	4/1		0/3
Tønsvikdalen	1/1	1/2	0/1		2/1
Tromsø					

Sakaguti and Jameson (1962) illustrated the spermatheca and st. VII (fig. 23D) of an extreme eastern record of *C. birulai*. Although their illustration of the male (fig. 23G) is indistinguishable from that of *C. birulai* throughout its range, the spermatheca and st. VII of the female are unlike those of *C. birulai* or any species of *Corrodopsylla*. Females were reportedly not examined in their study and it is unclear what female specimen they used for their drawing. Possibly specimens from Hokkaido represent a new taxon.

Ctenophthalmus (Ctenophthalmus) agyrtes agyrtes (Heller, 1896)

A series (8 males, 10 females) was collected from 5 of 10 specimens of *Arvicola terrestris* on the island of Bliksvær (Nordland) on 15 November 1999. This extends the known range of this subspecies north to nearly 67°N.

Megabothris walkeri (Rothschild, 1902)

This was the dominant flea found on *Arvicola terrestris*, occurring on 8 of the 29

specimens examined with a mean number of 3.4 fleas per positive host. It was not collected from any other host species and was associated with *C. a. agyrtes* on 5 of the same 8 animals. *Ctenophthalmus a. agyrtes* was also found only on *A. terrestris*. The fact that *M. walkeri* and *C. a. agyrtes* were associated in the pelage of the same animals and that neither flea was found on the majority (21/29) of the *A. terrestris* examined, would suggest that these 2 fleas share common requirements of their microhabitat. Smit (1969) suggested that *M. walkeri* was not found north of the Arctic Circle because of its requirements for high relative humidity in nests. *Arvicola terrestris* often lives in humid conditions, i.e., rich soil close to small patches of fresh water or swamp, which may provide suitable developmental conditions in some but not all habitats inhabited by *A. terrestris*. This might explain why *M. walkeri* occurs north of the Arctic Circle. The discovery of *M. walkeri* at Bliksvær (Nordland) extends the known range of this species farther north in

Table 1. Extended.

Flea Species									
<i>Hystri-</i> <i>chöpsylla</i> <i>orientalis</i> <i>orientalis</i>	<i>Ischnop-</i> <i>syllus hex-</i> <i>actenus</i>	<i>Mega-</i> <i>bothris</i> <i>rectan-</i> <i>gulatus</i>	<i>Mega-</i> <i>bothris</i> <i>walkeri</i>	<i>Nosop-</i> <i>syllus</i> <i>fasciatus</i>	<i>Palae-</i> <i>opsylla</i> <i>soricis</i> <i>soricis</i>	<i>Palae-</i> <i>opsylla</i> <i>soricis</i> <i>starki</i>	<i>Peromy-</i> <i>scopsylla</i> <i>bidentata</i> <i>bidentata</i>	<i>Peromy-</i> <i>scopsylla</i> <i>sylvatica</i>	<i>Rhadin-</i> <i>opsylla</i> <i>integella</i>
						0/2			
			17/10						5/1
		2/1			0/4				
0/1					8/5				
					1/0		1/2		1/0
0/1		0/1							
		1/0			0/5				
					1/4				
					0/1				
	0/1	0/3			0/1			1/0	
8/6		2/3			29/18			0/1	0/2
		5/6			14/26		1/2	6/34	3/0
					16/8				
				3/2					

Norway than previous records from Trondheim (Mehl 1967c).

Palaeopsylla soricis soricis (Dale, 1878)

This species commonly infests the shrew *Sorex araneus*. *Sorex araneus* was the most abundant mammal collected in this study (376 specimens) and consequently accounted for 45% of the fleas. *Palaeopsylla s. soricis* is reported only along the coast of Norway (Brink-Lindroth 1972, Smit 1969). It is replaced inland in southern Norway and Sweden by *P. s. rosickyi* Smit, 1960 and to the north by *P. s. starki* Wagner, 1930. *Palaeopsylla soricis* subspecies are distinguishable only in the males. Females without accompanying males from Straumvatnet, Råndalen, Kirkesdalen, and Dividalen are considered *P. s. soricis* based on their geographic distribution. Both males and females were taken from Skibotndalen, Kvaløya, and Tønsvikdalen. The apical dorsal sclerite of the aedeagus was typical of *P. s. soricis* while reticulations of the distal

portion of the apex of the lateral wall demonstrated an intergrade with *P. s. rosickyi*. Reticulations of the lateral wall were present in only one of 3 males from Tønsvikdalen. Two females (without accompanying males) from Vestre Jakobselv were considered *P. s. starki* because of their extreme northern distribution.

Rhadinopsylla integella Jordan and Rothschild, 1921

In the literature, *Clethrionomys glareolus* is the most common host of *R. integella*. In our study, 6 of 11 specimens were collected from *A. terrestris* from the island of Bliksvær (Nordland). No species of *Clethrionomys* were collected during these studies on this island. Most, if not all members of this genus, are nest fleas, consequently, specimens are seldom collected and usually no more than 1 or 2 specimens are ever collected on a single animal. This is the first time this species has been taken from *A. terrestris* in Norway.

Table 2. Host flea associations north of the Arctic Circle (number of males/number of females).

Host Positive hosts/total hosts	Flea species					
	<i>Amalaraeus penicilliger pedias</i>	<i>Amphipsylla sibirica sibirica</i>	<i>Corrod- opsylla birulai</i>	<i>Ctenoph- thalmus agyrtes agyrtes</i>	<i>Ctenoph- thalmus uncinatus uncinatus</i>	<i>Hystri- chopsylla orientalis orientalis</i>
<i>Arvicola terrestris</i> (10/29)				8/18		
<i>Clethrionomys glareolus</i> (2/65)					0/1	
<i>Clethrionomys rufocanus</i> (14/121)	3/10	1/4				
<i>Clethrionomys rutilus</i> (14/134)	20/23	14/10			0/2	7/3
<i>Eptesicus nilssonii</i> (1/1)						
<i>Microtus agrestis</i> (4/60)	1/0	1/0				0/1
<i>rattus norvegicus</i> (1/1)						
<i>Sorex araneus</i> (?/376)	3/5	8/6	7/4		2/4	1/3

ISCHNOPSYLLIDAE

Ichnopsyllus hexactenus (Kolenati, 1856)

A single female of *I. hexactenus* was collected from a juvenile *Eptesicus nilssonii* (Keyserling and Blasius, 1839) in Kirkesdalen (several hundred kilometers north of the Arctic Circle) on 12 August 2001. Smit (1966) also reported *I. hexactenus* from *E. nilssonii* in Switzerland but considered it an accidental association. This bat flea is a common parasite of *Plecotus auritus* (Linnaeus, 1758) throughout Europe and the British Isles. Although *P. auritus* also occurs in the southern half of Norway, *I. hexactenus* has never been documented there. *Eptesicus nilssonii*, a very common bat throughout Norway, is undoubtedly associated with *P. auritus* where they are sympatric well below the Arctic Circle. Since *P. auritus* and *E. nilssonii* are considered non-migratory species, usually moving less than 100 km, it is puzzling how this flea is associated with *E. nilssonii* so far out of the range of its usual host. Perhaps either one or both of these bats migrate further, or *E. nilssonii* may be a more important host than records might indicate. Further ectoparasite studies of both these bat species in Norway, both north and south of the Arctic Circle, are warranted to resolve this question.

LEPTOPSYLLIDAE

Amphipsylla sibirica sibirica
(Wagner, 1898)

Smit (1969) indicated that *A. s. sibirica* is an uncommon flea, although it is a widely

distributed species. Our series of 51 specimens collected from both cricetid rodents and *S. araneus* might indicate otherwise. A sex ratio of 1:1 is noted.

Peromyscopsylla bidentata bidentata
(Kolenati, 1863)

Although *P. b. bidentata* has been recorded numerous times in Finland, there are no records in Sweden and only a single male was reported by Jellison (1962) from Hamar, Norway. This is the first record of *P. b. bidentata* in Norway north of the Arctic Circle. Only 6 specimens were collected. Smit (1969) indicated that this is a winter flea. This may explain why it is infrequently collected in its northern range. Jellison's specimen was collected in the spring and ours in the late fall.

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Table 2. Extended.

Flea Species								
<i>Ischnopsyllus hexactenus</i>	<i>Megabothris rectangulatus</i>	<i>Megabothris walkeri</i>	<i>Nosopsyllus fasciatus</i>	<i>Palaeopsylla soricis soricis</i>	<i>Palaeopsylla soricis starki</i>	<i>Peromyscopsylla bidentata bidentata</i>	<i>Peromyscopsylla sylvatica</i>	<i>Rhadinopsylla integella</i>
		17/10						5/1
	1/0							
	3/5			0/1		0/2	3/8	
0/1	3/5			0/3		1/2	3/13	1/2
	0/1						0/3	
	2/2		3/2	69/65	0/2			2/0

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